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ABSTRACT

This study examined the relationship between test results of students in PRIMETIME first-grade classrooms in Indiana, and the Smith and Glass (1979) class size/achievement model. The class size/achievement model shows the results of a meta-analysis of research on class size which indicated that as class size decreases, achievement increases. The PRIMETIME project reduced the student/teacher ratio in first grade classrooms to 14:1. The current study examined 10 sets of data collected from over 2000 first-grade classrooms. Only 3 of the 10 studies examined reported a positive relationship between decreased class size and increased achievement scores. The conclusion of this study is that reduced class size is necessary, but not sufficient, to increase achievement scores. The role of teaching methods in small classes as a factor in increasing test scores is discussed, as are other contributing variables which may have affected achievement scores. It is recommended that PRIMETIME be continued, but that teaching methods and materials in smaller classes also be changed to increase achievement. (PCB)

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A Study of the Relationship Between Class Size and Achievement

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Abstract

The purpose of the study was to examine the relationship between PRIMETIME test results and the Smith and Glass class size/achievement model. Ten sets of data from schools throughout Indiana were reviewed. The conclusion of this review was that the relationship between test scores and class size was not the one proposed by Smith and Glass as shown in their model. There appeared to be other contributing factors to increasing achievement scores.

Background of the Problem

For the past decade, class size has been a big issue in education. Teachers and parents have the belief that students learn more if the student/teacher ratio is below 20:1. Common sense says that students will learn more if the student/teacher ratio is kept low, but does more learning really occur? If the student/teacher ratio is below 20:1, are the student achievement scores higher?

Since many researchers have concluded that by reducing class size achievement scores increase, state education departments have decided to budget money specifically to reduce class size. This is usually done to maintain a 20:1 or lower student/teacher ratio. Indiana is one state that has decided to spend millions of dollars to implement PRIMETIME into the schools systems as a way of improving achievement scores.

Robert D. Orr, Governor of Indiana, and Harold H. Negley, former Superintendent of Public Instruction, proposed the PRIME-TIME project, which was implemented in the state as an experiment in 1981. The two year project was implemented in 24 kindergarten through second grade classes in nine schools across Indiana and reduced the student/teacher ratio to 14:1. The project was reported to be successful after two semesters as the students exceeded normal achievement in both reading and math. The success of this experimental project resulted in PRIMETIME being implemented in all first grade classes in Indiana in 1984-85. (Sava, 1984) Was the increase in achievement scores related to a reduction in class size or were there other factors?

PRIMETIME's basic assumption is that to be effective in increasing academic achievement, class size must be reduced in the primary grades.(Sava, 1984) Therefore, PRIMETIME's thrust to date has been designed to identify and remedy learning problems in first through third grades. The Indiana Department of Public Instruction Report (1983) claims there is evidence that smaller class size will show positive effects.

On the contrary, Educational Research Review (1978) published its report on the relationship between class size and achievement and reported inconclusive evidence between class size and achievement. In fact, the results of their study did not indicate that there is an optimum class size for all grade levels. The study did show support that smaller classes in reading and math are related to increased achievement for primary children of lower academic ability as well as socially and economically disadvantaged students.

Shortly after the ERS report was published, Smith and Glass (Glass, Cahan, Smith and Filby, 1979) undertook a four months literature search and turned up nearly 80 studies on class size. The studies dated back from 1900 and involved more than 900,000 pupils. From this literature search, many comparisons were made of the achievement test results. After tabulating all the results, the conclusion was made that as class size decreases achievement increases, particularly when class size falls below the 20:1 student/teacher ratio. Only a small difference was found between classes of 20-40 students. Therefore Smith and Glass developed a class size/ achievement model showing the

results of their meta-analysis. (See Appendix A) Smith and Glass's findings were favorably accepted by many educators who wanted to believe that decreasing class size would increase achievement.

Supporting this finding, Wexler (1980) stated that researchers suggest in their findings that "smaller class size does significantly increase learning--particularly when the teacher takes full advantage of the opportunity to do more with fewer pupils." Wexler also added that "when freed from constraints of large classes, some teachers made good use of the added time and space available. Increased student achievement was noted in all the smaller classes."

However, ERS (1980) was skeptical of the findings of the Smith and Glass study. Their skeptism centered around the following points:

1. Only 60% of their studies showed significance.
2. Several of the claims made were not supported.
3. Smith and Glass said pupil achievement was not influenced by subject taught, direction of instruction, IQ and type of achievement measure.
4. Many of the studies were not used in final recommendation and the ones that were used were not representative of typical class, [e.g. secondary classes, small tutorial classes.]

ERS (1980) maintains that "reducing class size alone would not increase pupil achievement." ERS found that if teachers use the same methods in smaller class as in larger class, there would be no benefits derived. Also, at the primary level, evidence shows that smaller classes produce higher achievement in reading and math if students remain in small classes for two or more

consecutive years.

Not all studies show a positive relationship between class size and achievement. In a later study, Hallinan and Sorensen (1985) concluded that class size and achievement is not the issue. Their claim is that "in classes where teachers employ whole-class instruction, class size has no significant effect on learning. In classes where students are ability-grouped for instruction, group size rather than class size affects achievement with students in larger ability groups learning less than those in smaller ability groups." They conclude that class size has no effect on achievement in classes of between 25 and 36 students.

As far back as 1966, articles were written about class size. Cohen (1966) suggested that one teacher did not have a high enough energy level to give each child the individual attention necessary for high achievement when the student/teacher ratio was high. Cohen states that "class size must be so determined that each individual can receive from the teacher that share of emotional and cognitive attention which is a necessary ingredient of his growth as an independent, fully responsible learner who will in time become his own teacher." Cohen suggests that more is involved in the student/teacher relationship than mere presence.

Viewed another way, Cacha (1982) reported that the ERS found that efficient class sizes are a product of many variables, including subject area, nature and number of students in classroom, nature of learning, availability of material and instructional methods and procedures used.

However, Arlene Silberman (1978) concludes that "teachers tend to teach the same way to ten students as to 20 or 30." Down (1979) says that class size makes less difference than quality of teaching.

Just how important is class size in relationship to achievement? Does lowering the student/teacher ratio increase learning? If the Smith and Glass model is in fact correct, PRIMETIME scores in Indiana should increase as class size is decreased. If the educators who think that more is involved than just decreasing class size to increase achievement, then there will be no relationship between the Smith and Glass model and achievement scores in Indiana.

Statement of Problems

General Statement of the Problem: Does class size affect first grade students' academic achievements?

Specific Statement of Problem: Does reducing the class size increase first graders reading and math scores on the achievement tests?

Hypothesis: The relationship between test scores and class size is not the one proposed by Smith and Glass as shown in their model.

Methodology

The information studied involved the results of ten sets of data involving over 2000 first grade classes. The class size ranged from four in the smallest class to 43 in the largest. The schools were from different areas in Indiana and from different corporation sizes. Each of these classes were tested in 1984-85,

after PRIMETIME had been in effect for one year. Considering all known variables, no differences were noted about the subjects as a group and individual differences were assumed to be normally distributed.

Procedure

The tests administered to the students which measured math and reading achievement were: Iowa 400, Iowa 300, Metropolitan Achievement Test, SRA Achievement, Stanford and Gates-MacGinitee. Class size and tests scores were given for each set of scores. The results from the sets of data given in the studies were plotted on graphs and compared to the Smith and Glass model.

Results

The results of the math and reading achievement scores of the ten sets of statistical data are as follows:

Study 1: Two hundred ninety-five first grade classes with over 5300 students from throughout Indiana, class size 11-30, were given the Iowa 400 test in reading and math. The researcher concluded that no significant relationship between the Iowa 400 test and the Smith and Glass class size/achievement model exists. (See Appendix B)

Study 2: Fifty-nine first grade classes from a suburban school corporation in northern Indiana, class size 6-30, were given the Iowa 400 test in reading and math. The researcher concluded that no significant relationship between the Iowa 400 test and the Smith and Glass class size/achievement model exists. (See Appendix C)

Study 3: Two hundred ninety-eight first grade classes from the

Indianapolis public schools, class size 4-28, were given the Iowa 400 test in reading. The researcher concluded that a significant relationship between the Iowa 400 test and the Smith and Glass class size/achievement model exists. (See Appendix D)

Study 4: One hundred ninety-seven first grade classes from Indiana schools, class size 6-27, were given the Iowa 300 test in reading and math. The researcher concluded that no significant relationship between the Iowa 400 test and the Smith and Glass class size/achievement model exists. (See Appendix E)

Study 5: One hundred ninety-nine first grade classes from public schools in Indiana, were given the Iowa 300 test in reading and math. The researcher concluded that no significant relationship between the Iowa 400 test and the Smith and Glass class size/achievement model exists, but there was insufficient data to graph the results.

Study 6: One hundred ninety-five first grade classes from rural Indiana, class size 12-43, were given the Metropolitan Achievement test in reading and math. The researcher concluded that no significant relationship between the Metropolitan Achievement test and the Smith and Glass class size/achievement model exists. (See Appendix F)

Study 7: Seven hundred twenty-two first grade classes from throughout Indiana were given the Iowa 400 test in reading and math. The researcher concluded that no significant relationship between the Iowa 400 test and the Smith and Glass class size/achievement model exists, but there was insufficient data to graph the results.

Study 8: The year before PRIMETIME, over 800 first grade classes from throughout Indiana were given the following tests: Iowa, Stanford, Gates-MacGinitee, Metropolitan and local competency tests. The following year, when PRIMETIME was instituted, over 800 first grade classes from the same schools were given the same tests. The researcher concluded there was a significant difference in the results of the tests and as class size decreased achievement increased.

Study 9: Forty-nine first grade classes from schools in Indiana, class size 14-25, were given the SRA Achievement Test in math and reading. The researcher concluded that no signficant relationship between the SRA Achievement test and the Smith and Glass class size/achievement model exists. (See Appendix G)

Study 10: First and second grade classes from Crestview Primary Schools were given the Metropolitan Achievement Test. The report indicated there is a significant relationship between the Iowa 400 test only in second grade math when compared to the Smith and Glass class size/achievement model, but there was insufficient data to graph.

Only three of the ten researchers reported a significant positive relationship between decreased class size and increased achievment scores when compared to the Smith and Glass model. Therefore the hypothesis that the relationship between class size and achievement scores is not the one proposed by Smith and Glass must be accepted.

Discussion

Reduced class size is necessary, but not sufficient, to

increase achievement scores. Teaching methods may also be an important factor. The role of teaching methods in increasing test scores in small classes is discussed. These include individualization, hands-on experiences, more planning by teacher, positive attention, curriculum change, teacher attitude, learning centers, and oral activities.

The one obvious assumption that administrators and parents have when class size is decreased is that the teacher will give more individual attention to students. This is only an assumption. Many teachers use the same methods in teaching small classes and large classes. To increase achievement scores, the teacher must spend more time in a 1:1 situation with each student. Utilizing an individualized reading program requires a weekly conference with each child of at least ten minutes. Having small group activities provides more time for individual attention by the teacher. Also, hands-on activities can be provided to children in smaller classes as there is more time and space available.

Record keeping and paper grading time is reduced as class size is reduced. This frees the teacher to do more planning for individualized activities, plus making prescription exercises for those students who need specialized attention in certain areas.

Discipline problems should be reduced as the class size decreases, so classroom disruptions should be kept to a minimum. Since the classroom teacher has more time to spend with each child and each individual group, discipline problems should not be an issue.

The curriculum and materials provided to the PRIMETIME teacher may be the same as that used for large classes. These materials can be a guide to be used in skill development, but should be adapted to the small class. The basal reading series are used throughout the state. They should be used as a guide, but more time should be spent in uninterrupted sustained silent reading time and in individualized and language experience activities. Reading is learned through practice. Therefore, much printed material should be available for the children to read in the classrooms: children's books and magazines, poetry, riddles, games, and newspapers.

All of the class size research stated that teachers prefer small classes. Teachers have a higher energy level with fewer children in the room and thus have a more positive attitude. Teacher attitude affects the environment of the class and a positive teacher attitude can reinforce individuality and foster a good self-image. As a child's attitude is improved, achievement should increase.

Learning centers can provide information about many different subjects in a classroom. If the number of students in a class room is kept low, there is enough physical space to use learning centers. Science, social studies, language and math can all be introduced in non-threatening ways to children though the use of learning centers. These centers can lead to a desire to learn, and ultimately lead to higher achievement scores.

Teachers of large classes use many work sheets and workbooks as a way of keeping the students busy while giving individualized

or group attention in a certain subject. The use of a large number of worksheets and workbooks could be eliminated as the class size decreases as this is busy work without a purpose. Work sheets are considered by many to be the "junk food" of education. Oral individual and group activities can be used as an alternative to work sheets.

Writing is a tedious skill for children and the frustration level is reached quickly because penmanship, grammar, spelling and sentence structure are stressed. Teaching writing can be an agreeable activity if the teacher employs the semantic mapping approach, which encourages individuality and creativity in a non-threatening way. Since this method of teaching writing requires preparation time and individual attention, it usually cannot be incorporated in a class with a large number of students.

Conclusion

There are other contributing variables which were not accounted for in the data reviewed by the researchers of the ten studies reported in this paper. These variables may affect the achievement scores in particular classes. No explanation was given for the wide range of class size numbers within a particular school, e.g. 6-30. Were these all classrooms of normal children? It seems unlikely that a school would have four students in one class and 18 in another.

A small class (6-8) of physically handicapped students, in all probability, will score higher on an achievement test than a small class of emotionally impaired students. This should be expected. These classes should not be equally compared. Also a

school in an upper income family area will show higher achievement scores than one in a lower income family area. When comparing scores, this should be noted. If pre and post test scores were compared, the lower income family children may show a larger gain, but still have lower achievement scores than children in a upper income area. Ability grouped classes within a particular school should also be noted.

Recommendation

PRIMETIME should be continued in Indiana. Reduced class size is necessary to produce higher achievement scores, but not sufficient by itself. Smaller class sizes can produce higher achievement scores if teaching methods and materials are changed. If PRIMETIME only makes teaching an easier job because of less paper work and less preparation by the teacher, no gains will be made. Workshops, conferences, special classes, specialist assistance, inservice meetings, principal guidance and expert curriculum development should be made available to all teachers so that new techniques are implemented in all classrooms. Achievement can be increased. Indiana should prove it.

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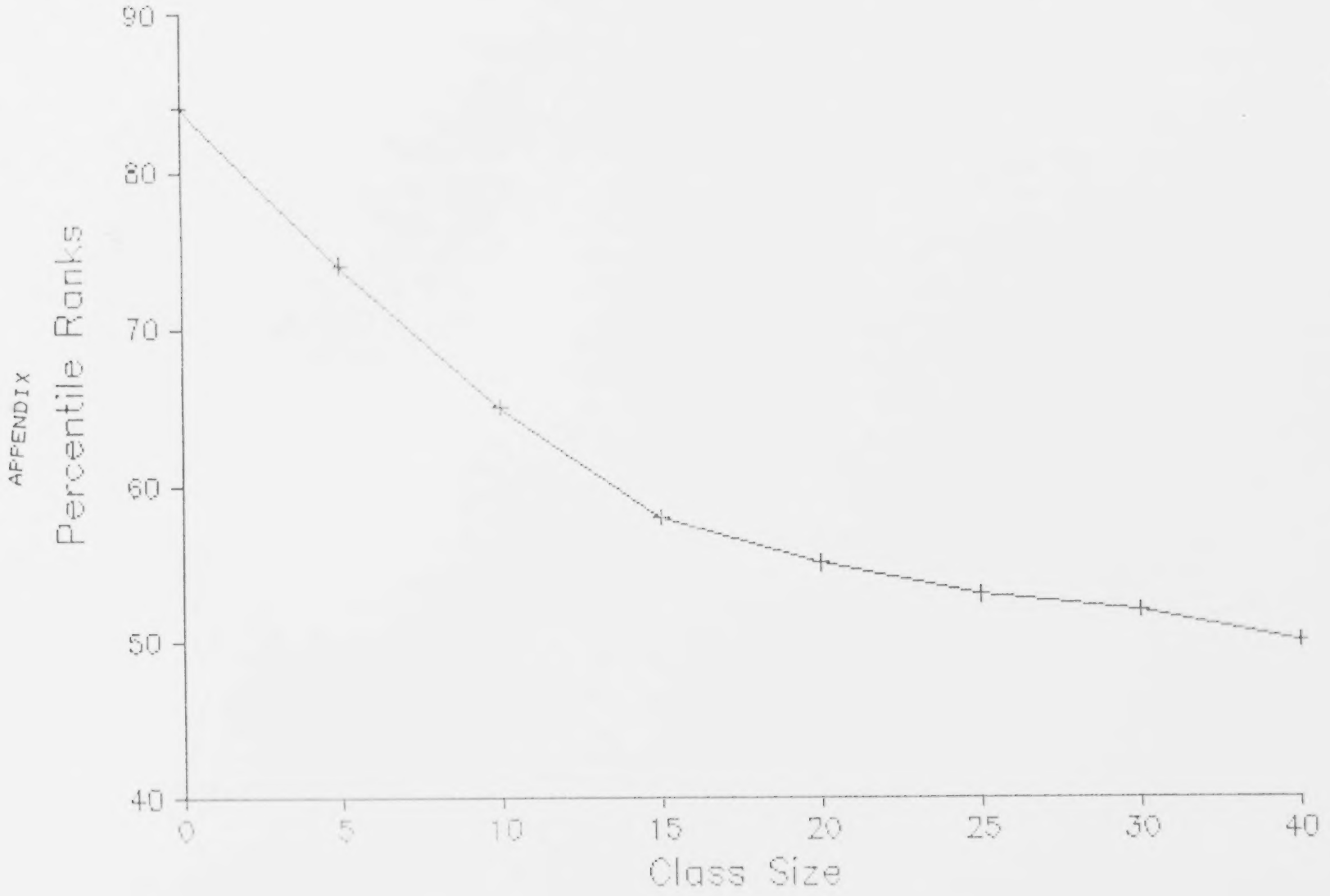
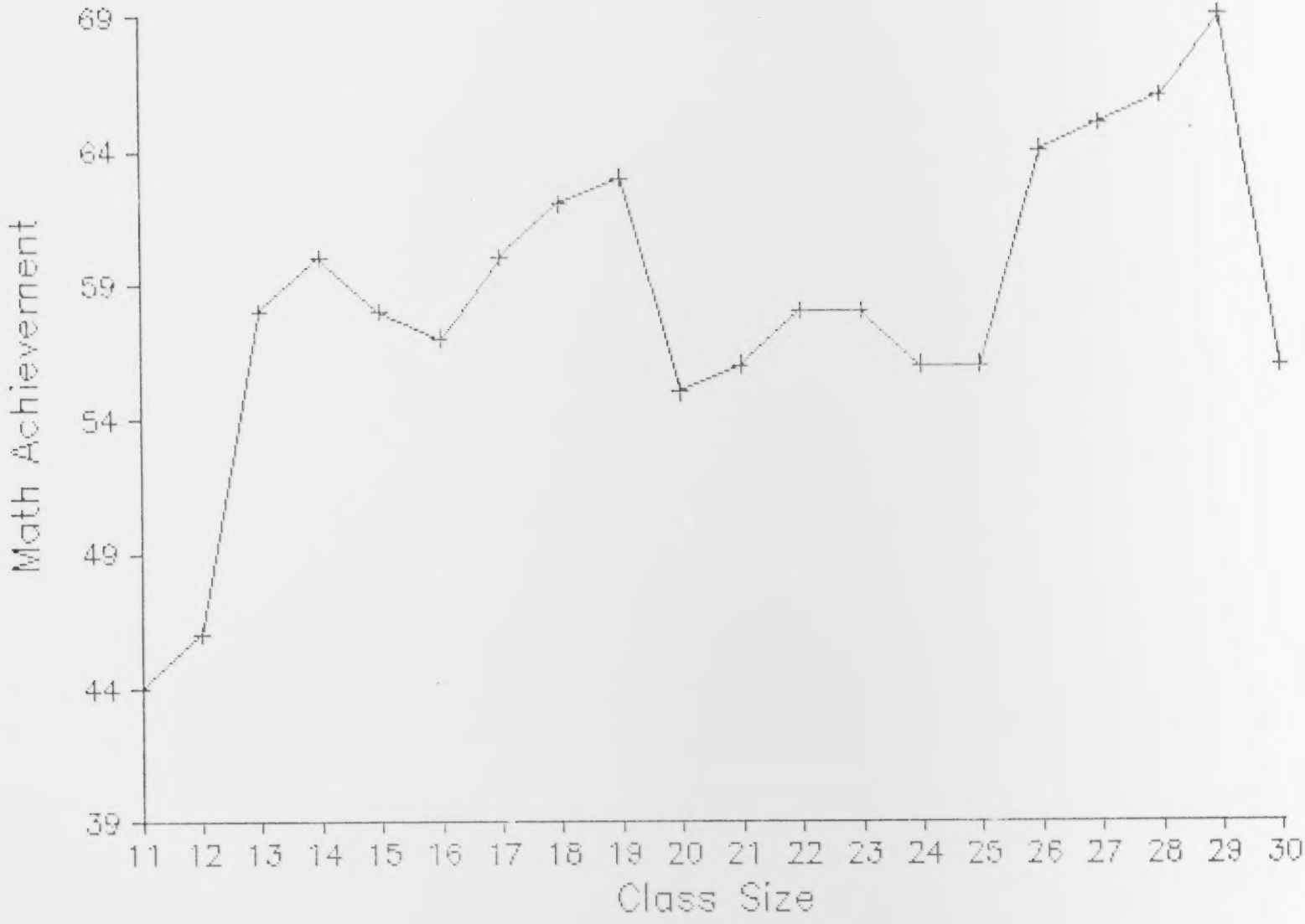
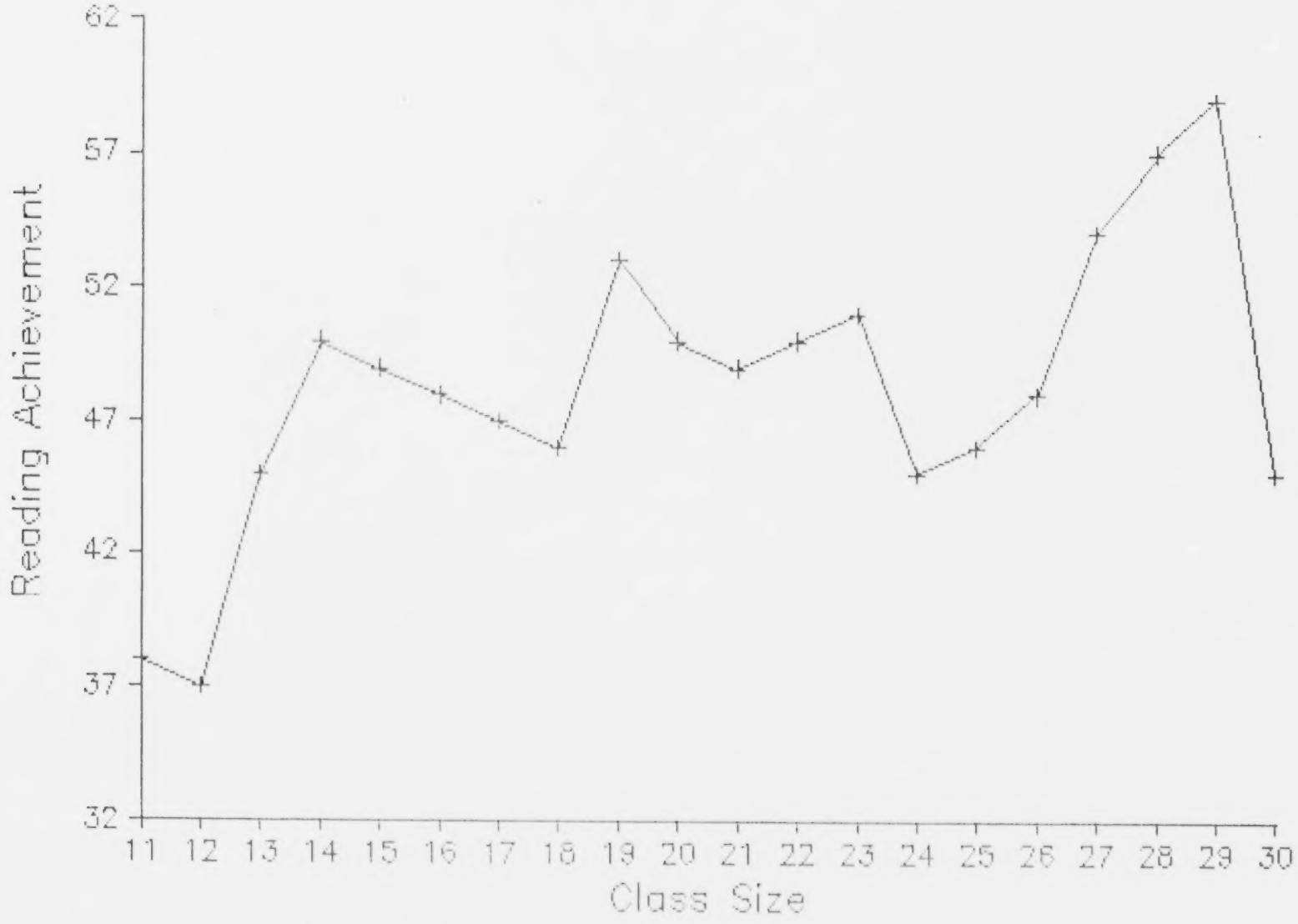
Appendix A Smith & Glass Model



Appendix B Math Achievement Scores



Appendix B Reading Achievement Scores



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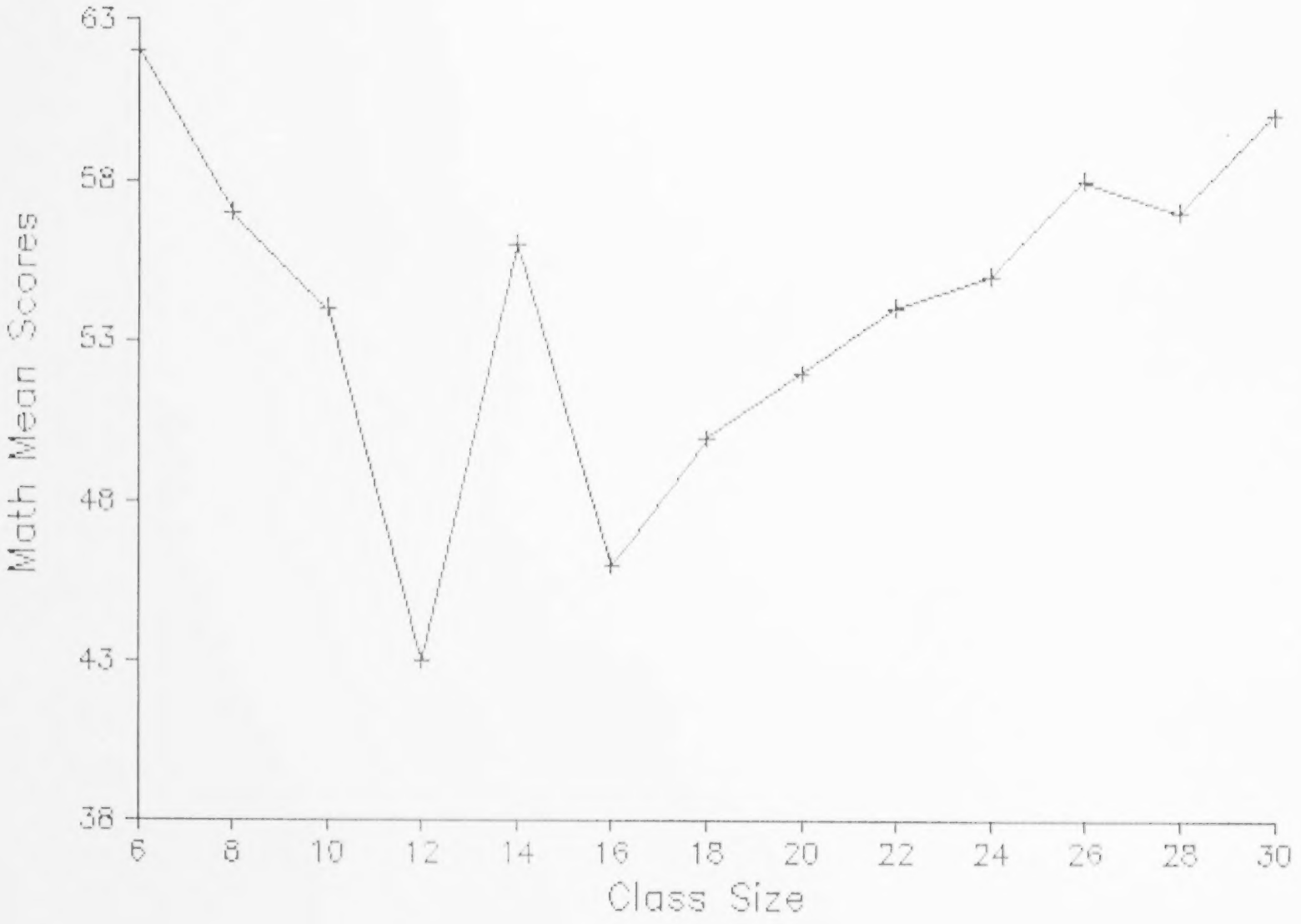

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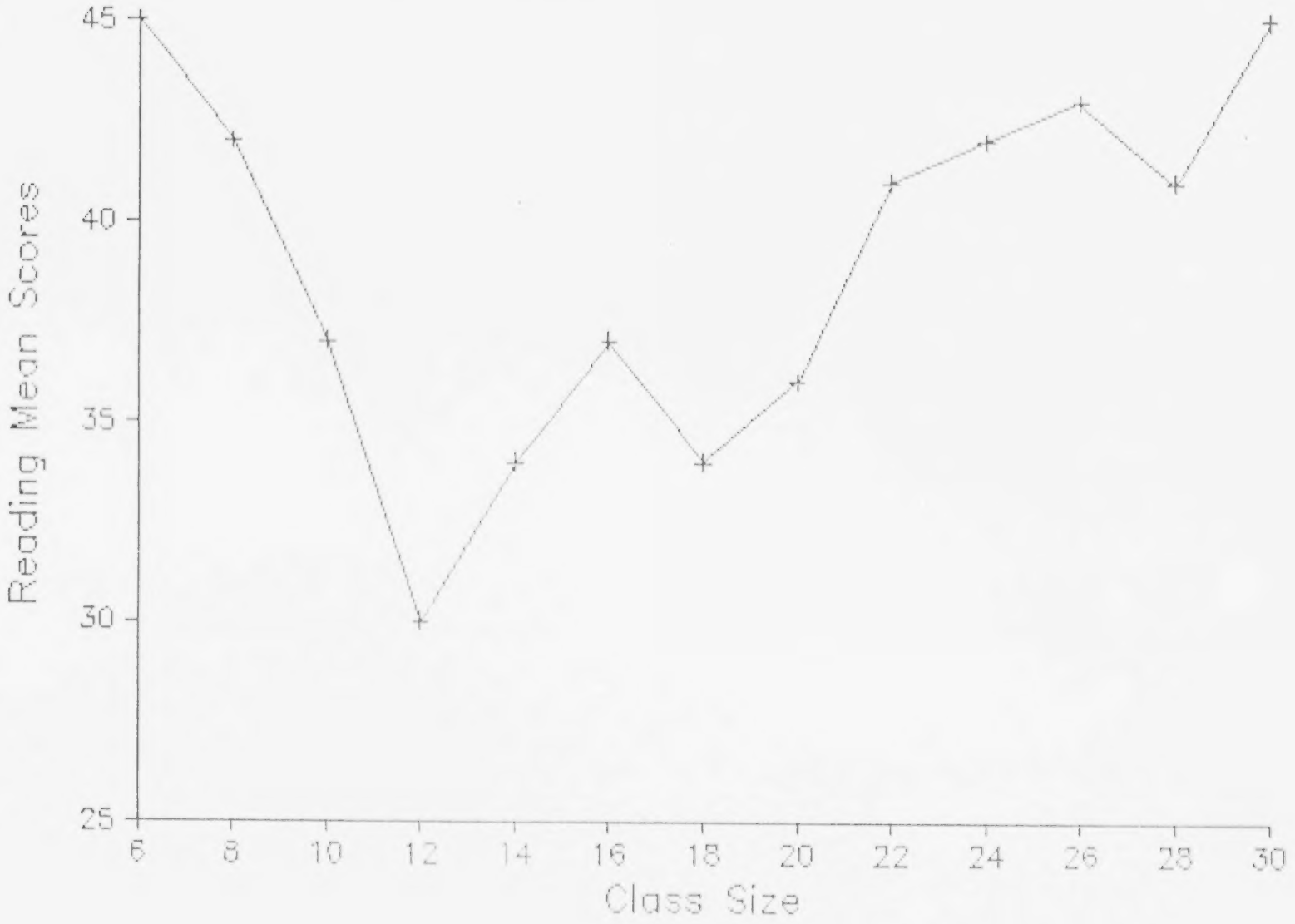
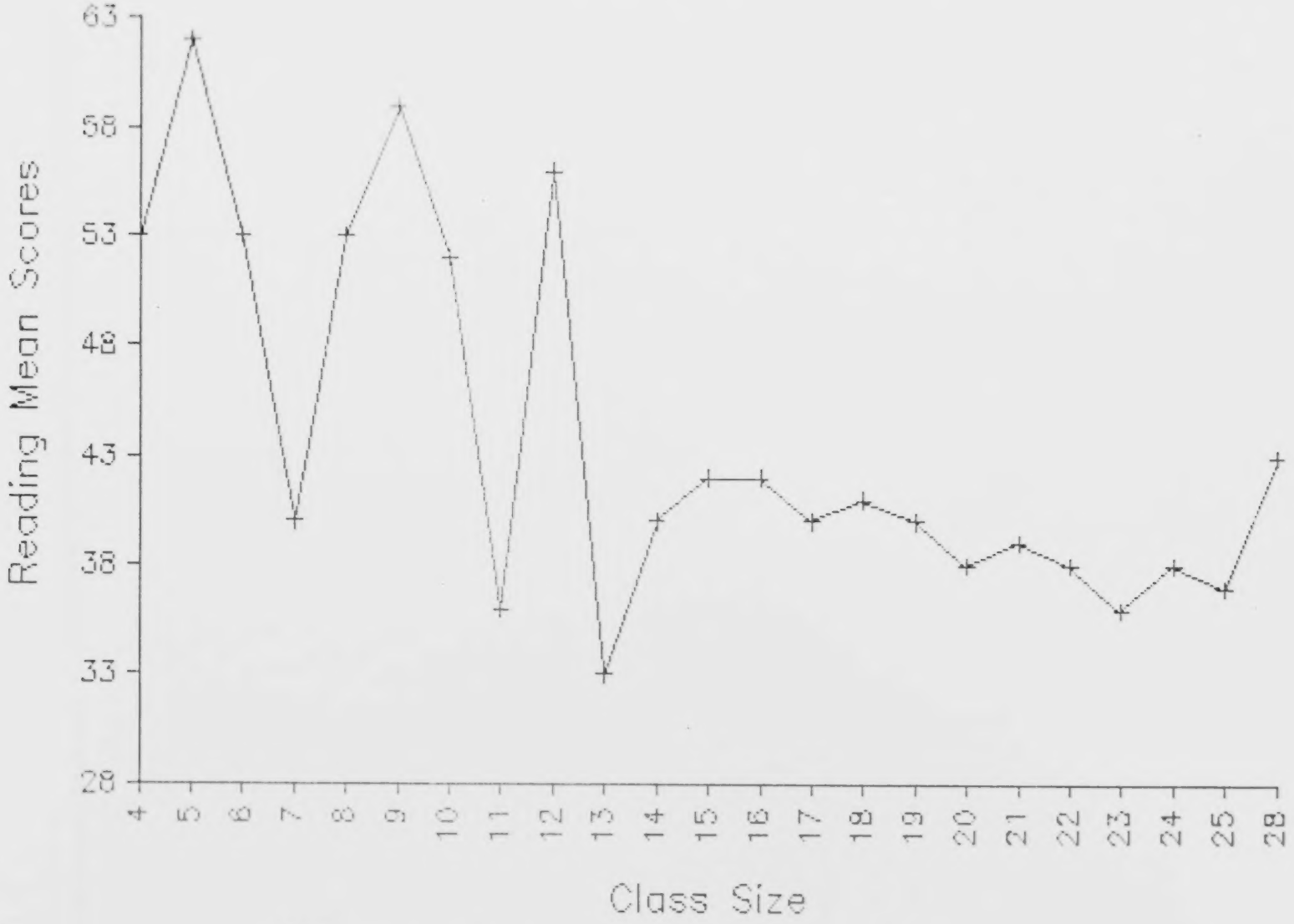


Appendix D Reading Achievement Scores



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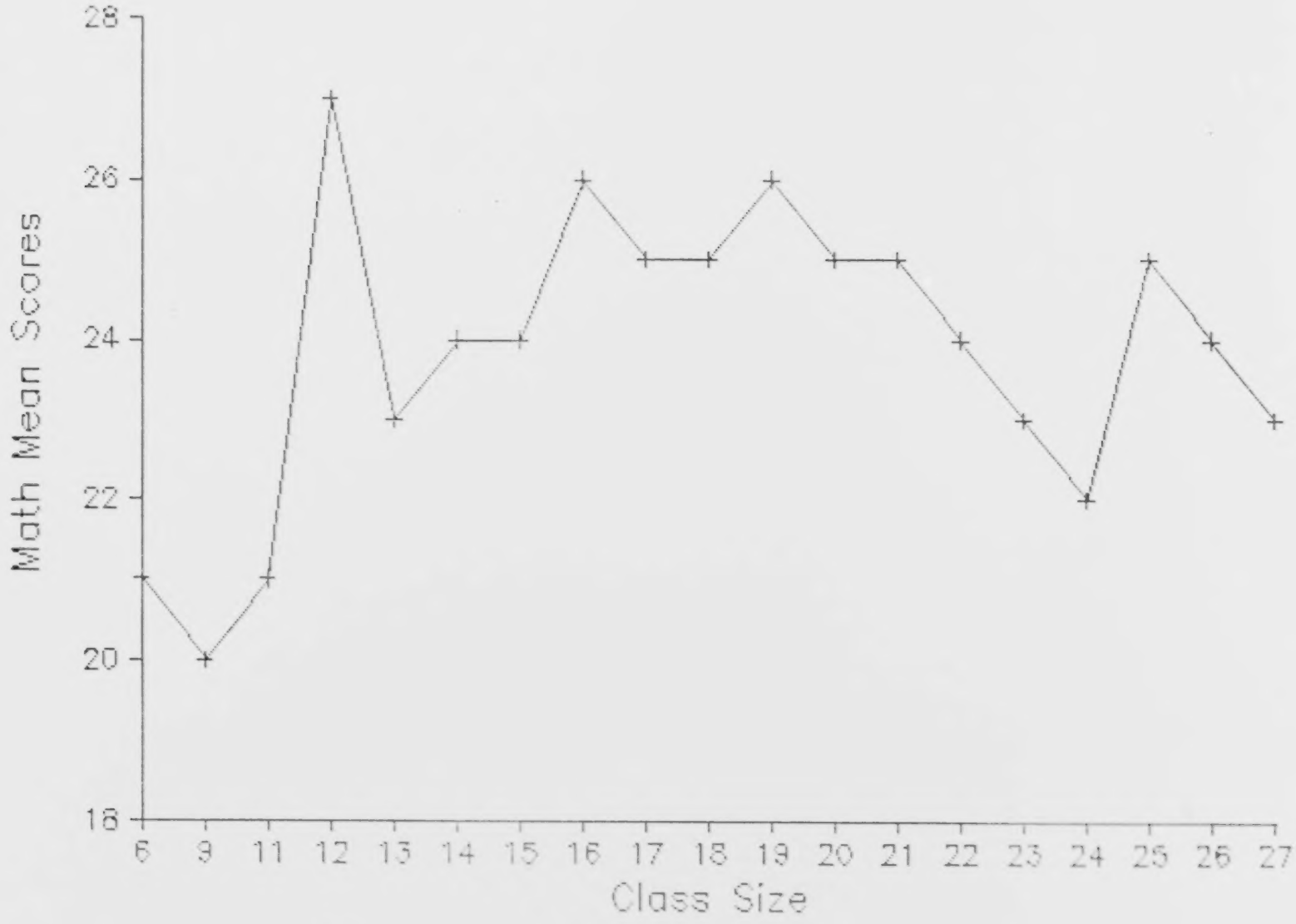

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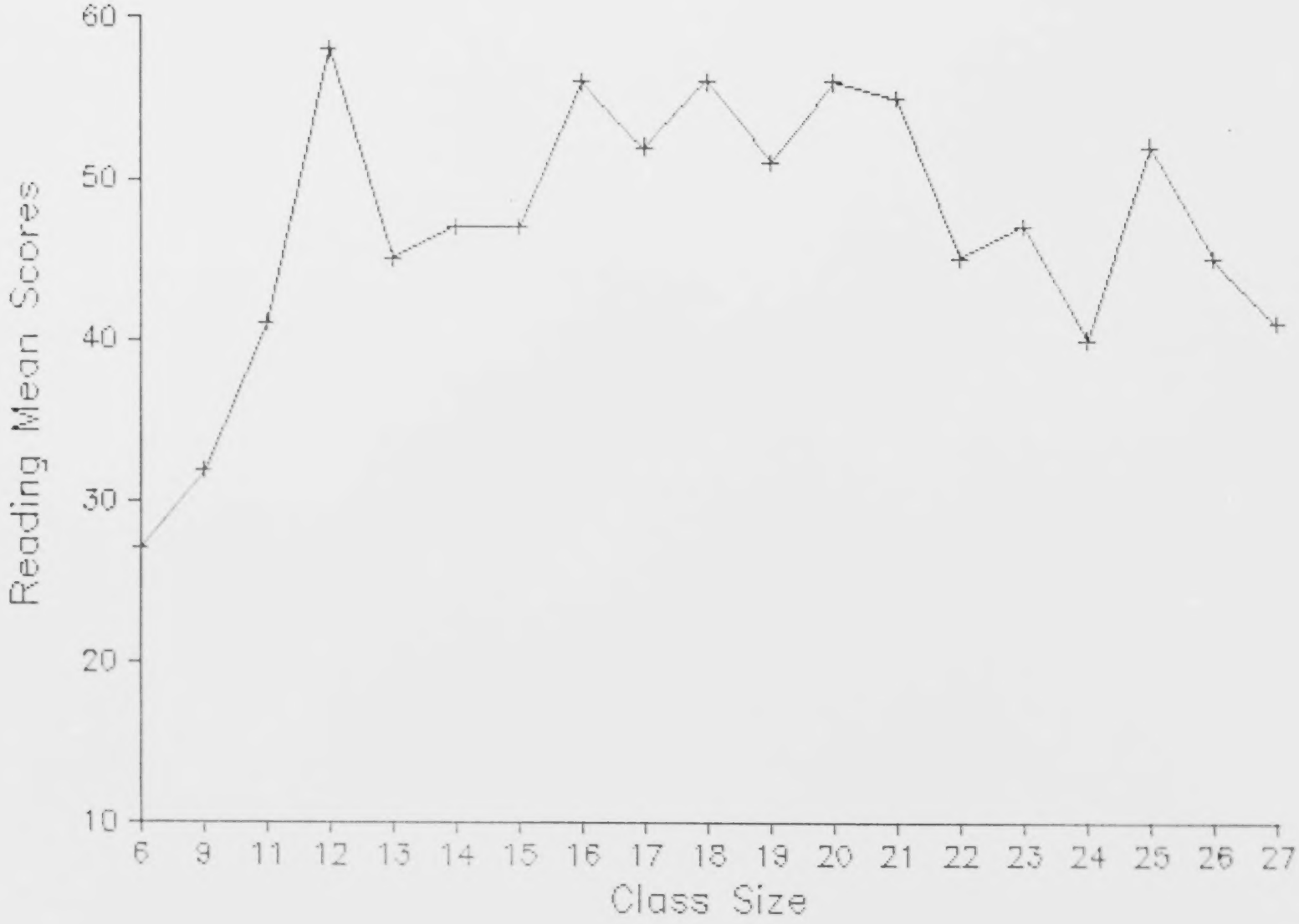
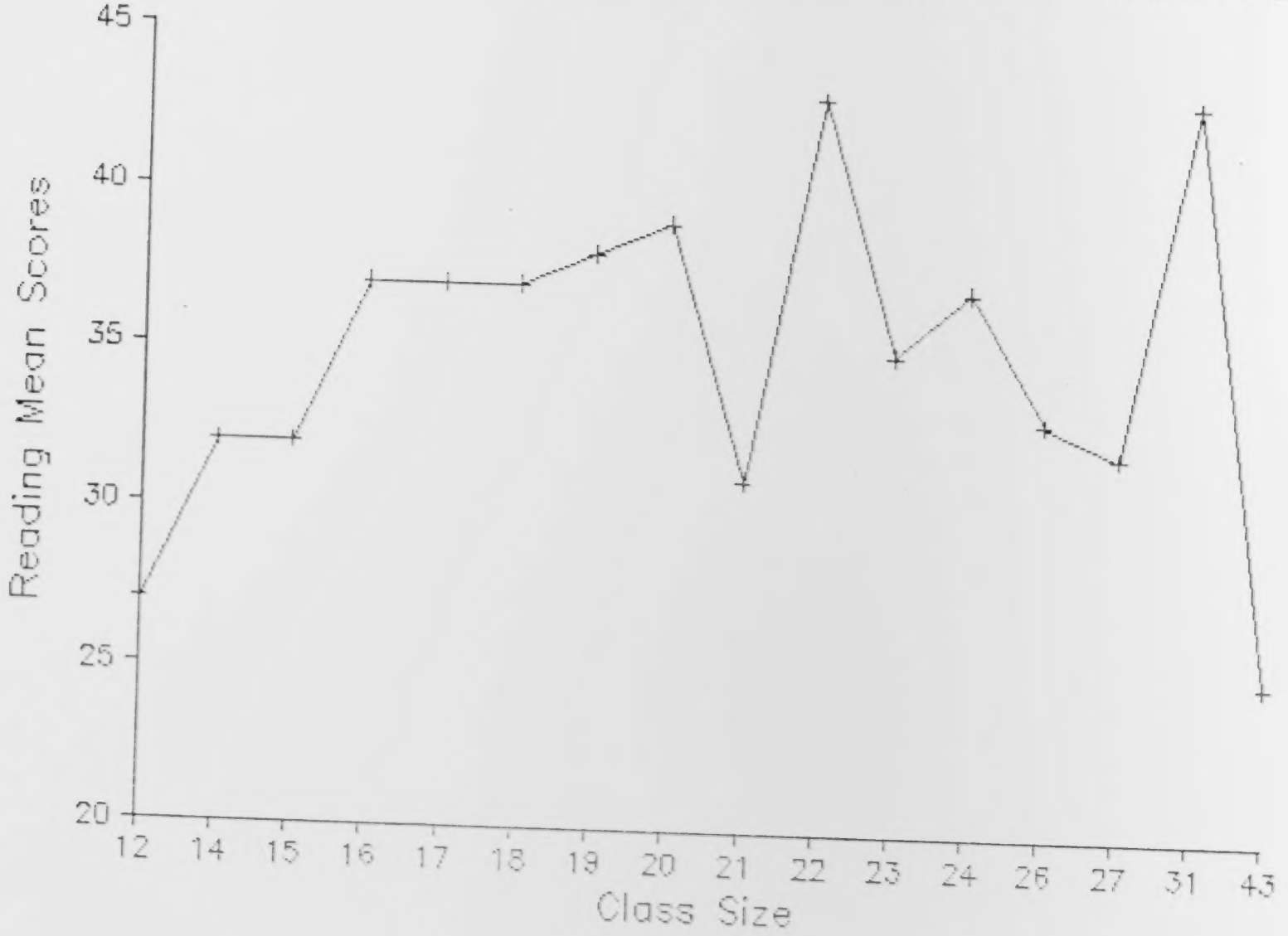


Appendix F Reading Achievement Scores



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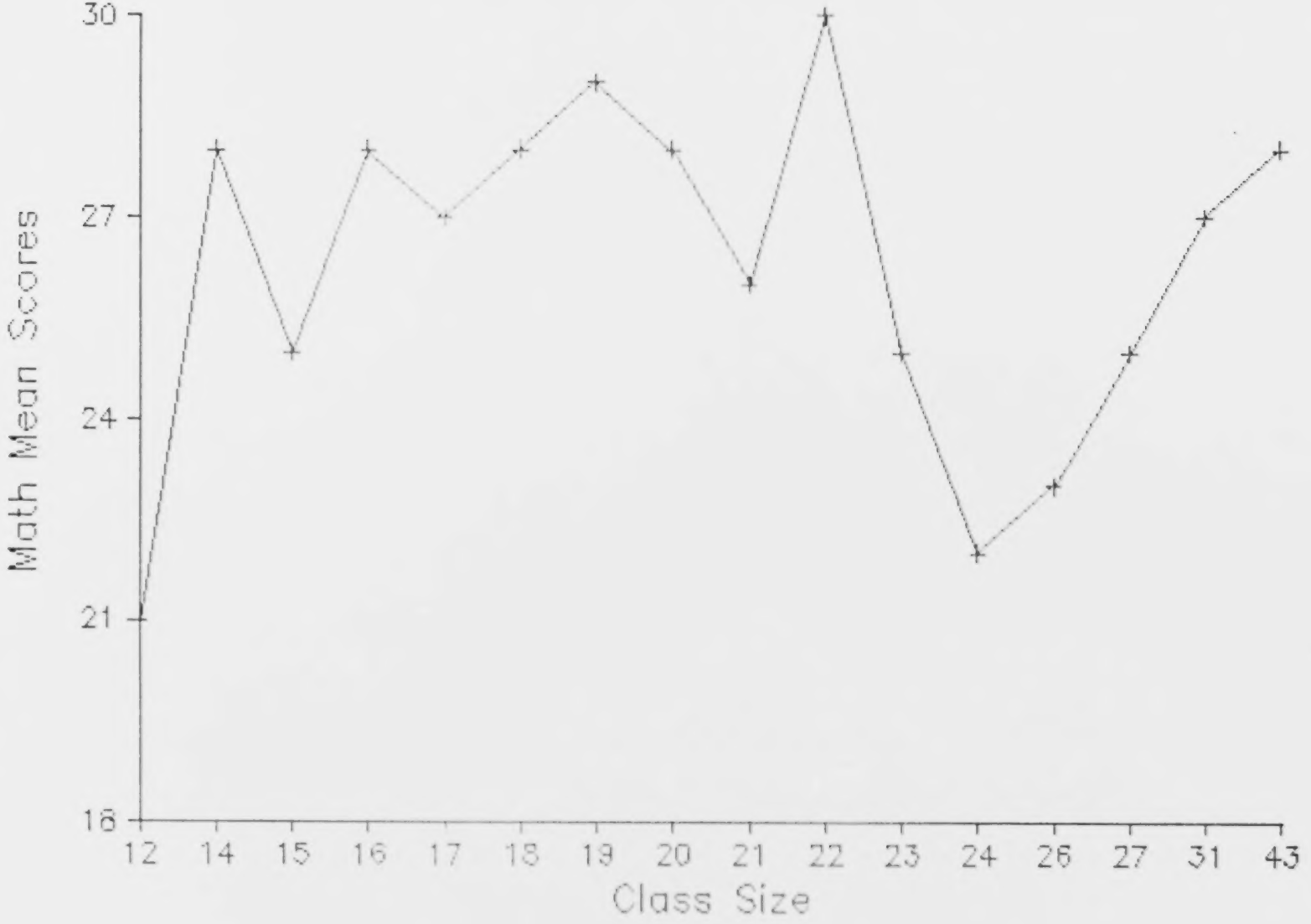
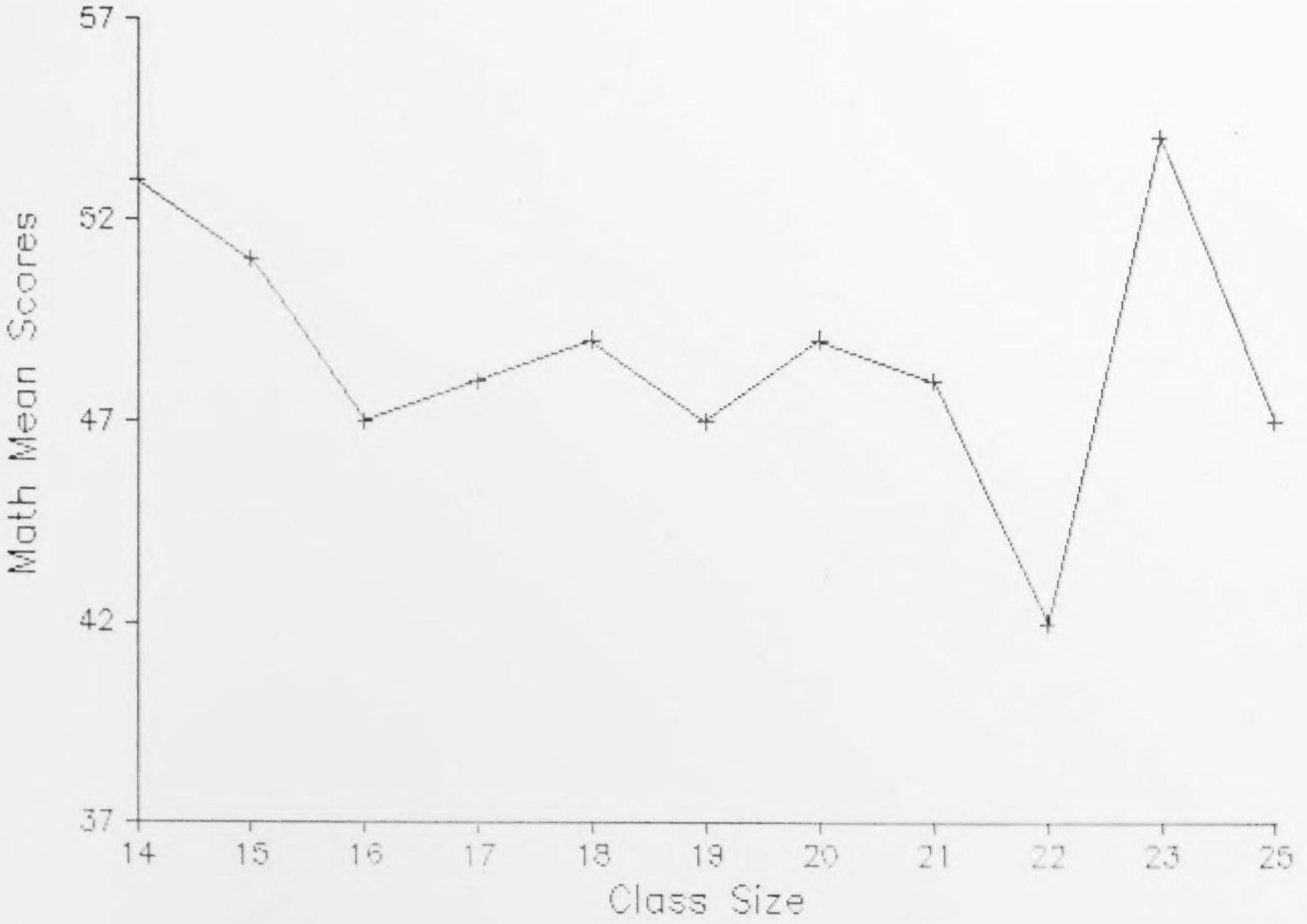


Appendix G Math Achievement Scores



Appendix G Reading Achievement Scores